Identification_Information:
  Citation:
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      Originator: National Oceanic and Atmospheric Association (NOAA)/National Ocean Service (NOS)/National Centers for Coastal Ocean Science (NCCOS)/Center for Coastal Ocean Science (CCMA)/Biogeography Team
      Publication_Date: 200102
      Title: St. Croix, USVI Habitat Assessment and Monitoring Data (2001 - Present)
      Publication_Information:
        Publication_Place: Silver Spring, MD
        Publisher: NOAA's Ocean Service, National Centers for Coastal Ocean Science (NCCOS)
      Online_Linkage: http://ccma.nos.noaa.gov/ecosystems/coralreef/reef_fish.html
  Description:
    Abstract:
      The intent of this work is three fold: (1) to spatially characterize and monitor the distribution, abundance, and size of both reef fishes and mega-invertebrates (conch, lobster, Diadema); (2) to relate this information to in-situ data collected on water quality and associated habitat parameters; (3) to use this information to establish the knowledge base necessary for enacting management decisions in a spatial setting and to establish the efficacy of those management decisions. Toward this end, the Center for Coastal Monitoring and Assessment's Biogeography Team (BT) has completed its fourth year and is beginning its fifth year of work in the US Virgin Islands and Puerto Rico. It is critical, with recent changes in management at both locations (e.g. implementation of MPAs) as well as proposed changes (e.g. zoning to manage multiple human uses) that action is taken now to accurately describe and characterize the fish/macro-invertebrate populations in these areas. It is also important that BT work closely with the individuals responsible for recommending and implementing these management strategies. Recognizing this, BT has been collaborating with partners at the University of Puerto Rico, National Park Service, US Geological Survey and the Virgin Islands Department of Planning and Natural Resources.

      To quantify patterns of spatial distribution and make meaningful interpretations, we must first have knowledge of the underlying variables determining species distribution. The basis for this work therefore, is the nearshore benthic habitats maps (<100 ft depth) created by NOAA's Biogeography Program in 2001 and NOS' bathymetry models. Using ArcView GIS software, the digitized habitat maps are stratified to select sampling stations. Sites are randomly selected within these strata to ensure coverage of the entire study region and not just a particular reef or seagrass area. At each site, fish, macro-invertebrates, and associated water quality and habitat information is then quantified following standardized protocols. By relating the data collected in the field back to the habitat maps and bathymetric models, BT is able to model and map species level and community level information. These protocols are standardized throughout the US Caribbean to enable quantification and comparison of reef fish abundance and distribution trends between locations. Armed with the knowledge of where "hot spots" of species richness and diversity are likely to occur in the seascape, the BT is in a unique position to answer questions about the efficacy of marine zoning strategies (e.g. placement of no fishing, anchoring, or snorkeling locations), and what locations are most suitable for establishing MPAs. Knowledge of the current status of fish/macro-invertebrate communities coupled with longer term monitoring will enable

evaluation of management efficacy, thus it is essential to future management actions.

Purpose: 1) To spatially characterize and monitor the distribution, abundance, and size of both reef fishes and macro-invertebrates (conch, lobster, Diadema); 2) To relate this information to in-situ data collected on water quality and associated habitat parameters; 3) To use this information to establish the knowledge base necessary for enacting management decisions in a spatial setting; 4) To establish the efficacy of those management decisions; and 5) To work with the National Coral Reef Monitoring Program to develop data collection standards and easily implemented methodologies for transference to other agencies and to work toward standardizing data collection throughout the US states and territories.

Supplemental_Information: This work is being conducted in collaboration with the University of Puerto Rico, National Park Service, US Geological Survey, and the Virgin Islands Department of Planning and Natural Resources.

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Range_of_Dates/Times:
Beginning_Date: 200102
Ending_Date: Present
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Use_Constraints Please reference NOAA/NCCOS/CCMA/Biogeography Team when utilizing this data in a report or peer reviewed publication. Additionally, knowledge of how this dataset has been of use and which organizations are utilizing it is of great benefit for ensuring this information continues to meet the needs of the management and research communities. Therefore, it is requested but not mandatory, that any user of this data supply this information to the Program Manager: Chris Caldow (email: chris.caldow@noaa.gov).
Point_of_Contact Contact_Information
Data_Set_Credit This is a cooperative effort between NOAA's Biogeography Team and the University of Puerto
Data_Quality_Information:
Logical_Consistency_Report: Not applicable
Completeness_Report: This data consists of multiple fish community surveys across all nearshore marine habitats around St. Croix, US Virgin Islands. Sites were randomly selected and stratified across by habitat types using NOAA's benthic habitat maps of St. Croix, USVI.
Lineage:
Process_Step:
Process_Description:
Site selection begins by stratifying NOAA's nearshore benthic habitat maps into predetermined habitat strata. Utilizing ArcGIS, sites are then randomly selected within strata throughout the region. Using a handheld GPS unit, the boat captain navigates to the previously selected sites. A weighted buoy is dropped to mark any site where "live boating" is necessary. Once on site, divers are deployed and maintain contact with each other throughout the entire census. One diver (hereafter the habitat diver) is responsible for collecting data taking detailed (microscale) habitat measurements along a 25x4-m belt transect. The habitat diver places a 1 m2 quadrat divided into 100 (10 x 10cm) smaller squares (1 square = 1 % cover or 100cm2) at 5 separate positions. Each position is randomly chosen before entering the water such that there is one random point within every 5 m interval along the transect. Percent cover is obtained as if looking at the quadrat in a two dimensional plane (i.e. a photograph) vs. three dimensions where percent cover could add up to greater than 100%.

Data are collected on the following:
1) Logistic information - (diver name, dive buddy, date, time of survey, site code, and meter #'s at which the quadrat is placed).
2) Habitat structure - to characterize the benthic habitats of the dive site, the habitat diver first categorize the habitat structure of the site (e.g., colonized hardbottom, spur & groove, patch reef, pavement). This is done

based on the hierarchical classification used in the benthic habitat maps (Kendall et al. 2001). The habitat diver must identify the broader categories (colonized or uncolonized hardbottom) and, if possible, also identify the more detailed subclasses. The habitat category to which a site is assigned should be made independently of the map so that in-situ data can be used for map validation.

3) Abiotic footprint - defined as the percent cover (to the nearest 1%) of sand, rubble, hard bottom, fine sediments, and other non-living bottom types within a 1 m2 quadrat. Rubble refers to large or small rocks and coral fragments that are moveable; immovable rocks are considered hard bottom. The percent cover given as a part of the abiotic footprint should total 100%. In a seagrass area for example, despite the fact that seagrass may provide 50% cover the underlying substrate is 100% sand so this is what is recorded.

To estimate % cover, the habitat diver first positions the quadrat at the chosen meter mark along the transect tape. If the meter mark is an odd number, then the quadrat is placed on left side of the tape; if even, it is placed on the right. Next, the habitat diver lays the quadrat along the substrate (regardless of the slope) and estimates % cover based on a two-dimensional (planar) view (e.g. if bottom is sloping, the quadrat is not held horizontally). Also, the diver should try to use the same planar view for all estimates of % cover. Percent abiotic cover data are reported for each site as an average of 5 random quadrat measurements.

4) Biotic footprint - defined as the percent cover (to the nearest 0.1%) of algae, seagrass, live corals, sponges, gorgonians, and other biota within a 1 m2 quadrat. The remaining cover is recorded as bare substrate to bring the total to 100%. Again, the diver must use a planar view to estimate % cover of the biota. Seagrasses and gorgonians should not be stacked upright. For example, e.g., if a single seagrass blade crosses 10 squares, then total seagrass coverage should be the sum of the area taken up by that blade in all 10 squares instead of the area covered if the blade was held upright. Species covering less than 0.1% of the area are not recorded. Taxa are identified to the lowest level possible (seagrass-species, algae-genus, sponge-sponge, stony coral-species, and gorgonians-morphological group).

When estimating percent cover, it is important to realize there is a balance between precision and time. For stony corals, the approximate area covered by living coral tissue is recorded. Coral skeleton (without living tissue) is usually categorized as turf algae or uncolonized substrate. Dead coral refers to coral skeleton that has recently lost living tissue because of disease or damage, and has not yet been colonized by turf algae. Turf algae include a mix of short (<1cm high) algae that colonizes dead coral substrate. Percent abiotic cover data are reported for each site as an average of 5 random quadrat measurements.

5) Shelter (fish refuge) characteristics - the number of holes smaller or greater than 15cm in the largest dimension. Hole-width or length is visually estimated. In rubble habitat with many holes (i.e. more than 40), haphazardly sub-sample the quadrat by counting the number of holes in three, 4cm squares (4 % of the quadrat) and then extrapolating to the entire 1m quadrat. Holes do not have to be fully enclosed; rather this is an estimate of places where fish might find refuge, so a ledge can suffice. The number of small and large holes are reported as an average of 5 quadrat measurements.

6) Transect depth profile - the depth at each quadrat position. Depth is measured with a digital depth gauge to the nearest 1 ft. Depth data are reported as an average of 5 quadrat measurements.

7) Maximum canopy height - for each biota type, height of both hard (e.g., corals) and soft (e.g., gorgonians, seagrass, algae) structure is recorded to the nearest 10cm. Canopy height is reported as an average of 5 quadrat measurements.

8) Rugosity - measured by placing a 6-m chain at two randomly selected positions along the 25-m belt transect. The chain is placed such that it follows the substrate's relief along the centerline of the belt transect. Two divers measure the straight-line horizontal distance covered by the chain (Figure 2). The chain is placed on top of any hard substrate encountered, but not on top of soft corals or sponges since we are measuring hard bottom rugosity. Data on rugosity are collected for reef sites only. Rugosity measurements typically are made by the point-count and belt-transect divers while awaiting the completion of other benthic habitat measurements by the habitat diver. Data on rugosity are reported as an average of two measurements along each transect.

9) Proximity of structure - on seagrass and sand sites, the habitat diver records the absence or presence of reef or hard structure within 3m of the belt transect. A score of zero (0) indicates that no reef or other hard structure is present; one (1) indicates that a reef or hard structure smaller than 4m2 is present; and (2) indicates that a reef or hard structure larger than 4m2 is present. The point-count diver also uses this scoring system to record the absence, presence, and proximity of reef or hard structures within their cylinder.

10) Abundance of queen conchs (Strombus gigas) - conch encountered within the 25x4m belt transect are enumerated. The maturity of each conch is determined by the presence or absence of a flared lip and labeled mature or immature, respectively. There is no active searching for conch.

11) Abundance of spiny lobsters (Panilaurus argus) - measured by counting the number of lobsters encountered within the 25x4m belt transect. No measurements are taken. There is no active searching for lobster.

12) Abundance of long-spined urchins (Diadema antillarum)- measured by counting the number of urchins encountered within the 25x4m belt transect. No measurements are taken. There is no active searching for Diadema.

13) Photography - the point count diver will take photos to maintain an anecdotal and permanent visual description of the sites that were sampled.

Data Caveats: Over time, some changes were made to the stratified random site selection process as follows: 1) Habitat strata initially consisted of hard bottom, sand, and seagrass. Sand and seagrass strata were subsequently combined into one soft bottom strata at all three locations (Puerto Rico, St. Croix, and St. John). This action was taken after the February 2002 mission to Puerto Rico. In Puerto Rico, mangroves are sampled in addition to the above strata. 2) In addition to the habitat strata, Puerto Rico originally contained three strata representing levels of protection from waves and currents. These strata were the Bank Shelf, Outer Lagoon and Inner Lagoon. This was changed beginning with the December 2002 mission to simply Protected and Unprotected. 3) A small subset of sites was resampled during each mission through June 2002 in Puerto Rico and October 2002 in St. Croix. These station names contain the letter 'P' indicating they are permanent stations. 4) During the first mission to St. John samples were also stratified by depth (<= 40 ft or >40 ft). 5) The sample area in St. Croix has increased over time. Initially, samples were collected within historic Buck Island National Monument boundaries as well as outside up to a distance of 0.5 km from those boundaries. In February 2002 the sampling effort was increased to include the entire expanded monument boundaries. Finally in April 2003 the effort was increased again to include areas outside of the Monument for control sites. This area is now almost entirely enclosed within the East End Marine Park of St. Croix. 6) The habitat map utilized to stratify the samples in St. Croix was changed from the original habitat map created with a 1 acre minimum mapping unit to one with a 100m2 minimum mapping unit beginning with the April 2003 mission.

Although the 1m-square-quadrat remained the basic method of choice for habitat data collection, overtime, changes in data collection methods were made for some habitat variables and several additional variables were added. These changes were deemed necessary to capture more precise information and as many variables as possible to explain better the observed variability in reef fish assemblage metrics. Detailed information on all changes to the protocols for collecting habitat data in Puerto Rico can be found at: http://www8.nos.noaa.gov/bpdm_web/metadata/stj_hab_metadata_table.pdf

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Longitude_Resolution: 5 decimal places

Geographic_Coordinate_Units: Decimal degrees

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Entity_and_Attribute_Overview: We supply percent cover, relative abundance, size, and composition of benthic communities at the lowest possible taxonomic level. This information is collected across all nearshore habitat types. In addition, we provide photographs of many of the taxa. For specific information please see the data dictionary available on the database website.

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Distributor:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: NOAA/NCCOS/CCMA/Biogeography Team

Contact_Position: Tropical Ecosystem Monitoring and Assessment Database Manager

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Address_Type: Mailing and Physical Address

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City: Silver Spring

State_or_Province: MD

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Contact_Voice_Telephone: 301-713-3028

Contact_Electronic_Mail_Address: tom.mcgrath@noaa.gov

Hours_of_Service: 9:00 - 5:00

Resource_Description: Downloadable data

Distribution_Liability: These data were prepared by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference therein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. Any views and opinions expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof. Although all data have been used by NOAA, no warranty, expressed or implied, is made by NOAA as to the accuracy of the data and/or related materials. The act of distribution shall not constitute any such warranty, and no responsibility is assumed by NOAA in the use of these data or related materials.

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Manager
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